Prevalence of Helminthic Infections and Risk Factors in Villagers of Nanglae Sub-District, Chiang Rai Province, Thailand

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The purposes of the present study were to survey the prevalence of helminthic infections in people living in Nanglae Sub-District of Chiang Rai Province, Thailand from January to March 2013, and to determine factors that correlated with these infections. Two hundred and sixty-three fecal samples were examined for helminth eggs by the use of Kato's thick smear technique. All data were analyzed by descriptive statistics including frequencies, percentages and correlations (Odds ratio [OR] and 95% confidence interval [CI]). The percentage of overall helminthic infections was 11.8%, comprising 6.1% Taenia spp., 4.5%, Ascaris lumbricoides, 0.8%, Strongyloides stercoralis and 0.4% flukes producing opisthorchiid-like eggs. In addition, the prevalence of helminthic infection correlated significantly with the consumption of raw meat (OR = 2.270, 95% CI = 1.047-4.923) and raising dogs in the house (OR = 2.444, 95% CI = 1.080-5.534).

Keywords: *Prevalence, Helminthic infections, Chiang Rai, Thailand*

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Helminthic infections are the most common infections worldwide[1,2]. About two billion people are affected and 450 million suffer illness because of these infections[1,2]. The majority of infections are found in children[2]. They can cause various important clinical symptoms, including malnutrition, iron deficiency anemia, malabsorption syndrome, intestinal obstruction, jaundice, pancreatitis, and injury to internal organs. Helminthic infections are governed by behavioral, biological, environmental, socio-economic, and health systems factors[3-5].

Helminthic infections are a public health problem in Thailand. Their prevalence in the country in 1981, 1991, 1996, 2001, and 2009 was 54.7%, 41.7%, 35.0%, 22.5%, and 18.1%, respectively[6]. The prevalence of helminthic infections in each region in 2009 was 5.8% (Central), 17.7% (Northern), 26.0% (Northeastern), and 19.8% (Southern). Chiang Rai Province, Northern Thailand, had more than 20% of the helminthic infections[6].

The results of an epidemiological study of helminthic infections in Muang District of Chiang Rai Province in 2012 showed the prevalence of helminthic infections was 21.1% and 36.7% in Nanglae Sub-district of Chiang Rai Province[7]. However, factors that may influence helminthic infections have not been studied in this community. Therefore, the aim of this study was to determine the prevalence of helminthic infections and factors correlating with them in Nanglae Sub-District, Muang District, Chiang Rai Province. It is anticipated that an understanding of these infections will be useful in the design of appropriate control measures.

Material and Method

Study design

A cross-sectional survey was conducted from January to March 2013 in Nanglae Sub-District, Muang District, Chiang Rai Province, Thailand. The objective of the study was explained to 263 volunteers who accepted the invitation to participate in the research. A

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questionnaire was issued to the participants to collect socio-demographic data related to age, gender, education, occupation, monthly income, and factors correlating with helminthic infections.

Specimen collection and examination

Stool samples were collected from the volunteers. A clean plastic container was distributed to each subject who was thoroughly briefed on the procedure for stool collection. They were advised to collect the first stool of the day, preferably in the morning. Each stool was brought back to the laboratory at the School of Health Science, Chiang Rai Rajabhat University. Stool examinations for helminthes were performed using Kato's thick smear technique[8,9].

Data analysis

Prevalence of helminthic infections was stratified according to age, gender, education, occupation, and monthly income. Descriptive statistics were used for the analysis of demographic data and prevalence of infections. The odds ratio (OR) was used for hypothesis testing to determine the correlations of different groups of factors correlated with helminthic infections. The p-values were considered statistically significant at $p<0.05$.

Results

Socio-demographic characteristics

The socio-demographic information of volunteers is shown in Table 1. The 263 volunteers included 89 males (33.8%) and 174 females (66.2%). The age range was 26 to 84 years old. The majority (62.0%) of the volunteers was farmers, 78.3% had education at primary school level, and 60.5% had a monthly income between 1,001 and 5,000 baht.

Table 1. Prevalence of helminthic infections in 263 volunteers from Nanglae Sub-District, Chiang Rai Province, Thailand

Variable	Helminthic infections	
	Number of infections/Total volunteers	%
Gender		
Male	11/89	12.4
Female	20/174	11.5
Age (years)		
<30	0/3	0.0
30-39	2/19	10.5
40-49	10/85	11.8
50-59	12/100	12.0
≥60	7/56	12.5
Education level		
No education	0/11	0.0
Primary school	26/206	12.6
Junior high school	3/18	16.7
Senior high school	2/18	11.1
Diploma	0/5	0.0
Bachelor degree and higher	0/5	0.0
Occupation		
Farmer	21/163	13.0
Merchant	3/28	10.7
Employee	5/52	9.6
Other	2/20	10
Monthly income (baht)		
<1,000	6/40	15.0
1,001-5,000	13/159	8.2
5,001-10,000	11/45	24.4
10,001-20,000	0/10	0.0
>20,000	1/9	11.1
Overall	31/263	11.8

Prevalence of helminthic infections

The prevalence of helminthic infections is shown in Table 1. The overall prevalence in this study was 11.8% and was found to be more endemic in males than in females. The socio-demographic characteristics that were found to be related to the highest prevalence of infection included 1) age-over 60 (12.5%), 2) education-secondary school level (16.7%), 3) occupation-farmers (13.0%), and 4) monthly income-range of 1,001-5,000 baht (24.4%).

Four species of helminthes were detected from the stool samples of the volunteers (Table 2). Eggs of *Taenia* spp. were found to be the highest (6.1%), followed by *Ascaris lumbricoides* eggs (4.5%), Rhabditi form larvae of *Strongyloides stercolaris* (0.8%), and opisthorchiid-like eggs (0.4%) (Table 2).

Factors correlated with helminthic infections

Correlations between helminthic infections and possible factors for these infections are shown in Tables 3 and 4. The prevalence of helminthic infections correlated significantly with the regular consumption of raw meat (OR = 2.270, 95% CI = 1.047-4.923) and raising dogs in the house (OR = 2.444, 95% CI = 1.080-5.534) (Table 3). In contrast, prevalence of the infections did not always correlate to wearing sandals outside, always wearing closed shoes outside, always wearing boots in the field, regular consumption of raw fish, always washing hands with soap before meals and after defecation, having a toilet in the house, and raising cats, cows, chickens, or birds in the house (Table 3). The regular consumption of raw meat correlated significantly with the prevalence of *Taenia* infection (OR = 4.007, 95% CI = 1.431-11.220). The raising of dogs in the house was found to correlate significantly with the prevalence of *A. lumbricoides* infection (OR = 4.805, 95% CI = 1.032-22.372) (Table 4).

Discussion

The high prevalence (11.8%) of helminthic infections found in this study is of clinical and epidemiological importance. The prevalence was higher than the threshold set (5%) by the Ministry of Public Health of Thailand[10]. However, the prevalence found in this study was lower than in other previous studies[6,7]. Control programs for helminthic infections are still a challenge in developing countries due to susceptibility of the host, favorable environmental conditions, low socio-economic levels, and unhygienic sanitary conditions[11-13]. Appropriate treatment must be provided and surveillance of these infections should be carried out continuously. Moreover, intermediate and reservoir hosts of the parasites need to be monitored in the future.

Helminthic infections were found to be more common in males than females. This may be due to the former belief that eating a raw diet strengthens their bodies[6]. The highest prevalence of helminthic infections was found in volunteers aged over 60 years (12.5%). Similarly, Naves and Costa-Cruz[14] found a high prevalence of *S. stercolaris* infection in the elderly (≥60 years old) in Brazil. Factors contributing to helminthic infections in that age group were occupation and behavior in relation to health and lifestyle habits.

Helminthic infection rates are known to vary geographically according to the factors influencing parasitic transmission. For instance, tapeworm infections tend to occur more frequently in Northeastern and Northern Thailand because people regularly eat raw or undercooked beef, pork, and/or fish[15]. Liver fluke infections are commonly found among rural communities in Northeastern Thailand, as raw fish consumption is a common practice among the population. Soil-transmitted parasites are prevalent in the southern region because the humidity and amount of rainfall are suitable for their life development and transmission[16]. The present study showed that tapeworms cause the highest rate of infections (6.1%) and the study that is the subject of this paper found a correlation between constant consumption of raw meat

Table 2. Prevalence of helminthic infections using Kato's thick smear technique with 263 volunteers from Nanglae Sub-District, Chiang Rai Province, Thailand

Helminth species	Stage	Number of infections/ Total of infection cases	% of infections
Taenia spp.	Egg	16/31	6.1
Ascaris lumbricoides	Egg	12/31	4.5
Strongyloides stercolaris	Rhabditiform larva	2/31	0.8
Opisthorchiid-like	Egg	1/31	0.4

Table 3. Correlation of risk factors with helminthic infections in 263 volunteers from Nanglae Sub-District, Chiang Rai Province, Thailand

Factors	Examined cases	Infected cases	Odd Ratio	95% confidence interval
Always wear sandals outside				
Yes	230	27	0.964	0.315-2.955
No	33	4		
Always wear closed shoes outside				
Yes	137	13	0.629	0.295-1.343
No	126	18		
Always wear boots in the field				
Yes	180	24	1.670	0.689-4.049
No	83	7		
Regular consumption of raw fish				
Yes	10	3	3.444	0.842-14.083
No	253	28		
Regular consumption of raw meat				
Yes	69	13	2.270*	1.047-4.923
No	194	18		
Always wash hands with soap before meals and after defecation			1.058	0.498-2.246
Yes	141	17		
No	122	14		
Have toilet in the house				
Yes	256	30	0.796	0.093-6.844
No	7	1		
Raise animals in household				
Yes	188	25	1.764	0.693-4.490
No	75	6		
Raise dogs				
Yes	138	22	2.444*	1.080-5.534
No	125	9		
Raise cats				
Yes	87	9	0.808	0.355-1.837
No	176	22		
Raise cows				
Yes	10	1	0.826	0.101-6.750
No	253	30		
Raise chicken				
Yes	22	1	0.335	0.043-2.581
No	241	30		
Raise birds				
Yes	2	0	0.000	0.000
No	261	31		

* Significant at the 0.05 level

and the prevalence of helminthic infections (OR = 2.270, 95% CI = 1.047-4.923), especially *Taenia* spp. Currently, three species of *Taenia* tapeworm, *Taenia solium*, *Taenia saginata*, and *Taenia asiatica*, have been shown to be a cause of taenias is in Thailand[17]. Molecular and serological methods should be applied for the determination of the species of *Taenia* tapeworm and screening for cysticercosis, a lethal parasitic disease caused by *T. solium*, in this area. In addition, the cycle of transmission must to be disrupted by the provision of education, promotion of the consumption of cooked meats, and the elimination of the exposure of

Table 4. Correlation between specific helminthic infections and risk factors in 263 volunteers from Nanglae Sub-District, Chiang Rai Province, Thailand

Helminth species	Raise dogs		Regular consumption of raw meat	
	Odd Ratio	95% confidence interval	Odd Ratio	95% confidence interval
Taenia spp.	2.079	0.702-6.159	4.007**	1.431-11.220
Ascaris lumbricoides	4.805*	1.032-22.372	0.934	2.46-3.556
Strongyloides stercolaris	0.905	0.056-14.625	2.838	0.175-46.004
Opisthorchiid-like	0.000	0.000	0.000	0.000

* Significant at the 0.05 level, ** Significant at the 0.01 level

livestock to the tapeworm eggs by the proper disposal of human feces[18].

The present study revealed that almost all soil-transmitted helminthes found in this study were *A. lumbricoides* (4.5%), a very common roundworm that is thought to infect about 25% of the world's population, mostly children[19]. Infection rates are high in tropical developing areas with poor sanitation and low levels of hygiene[20-23]. Basically, a high level of human feces in the environment and lower levels of hygiene lead to a greater the risk of accidentally ingesting parasite eggs. The area involved in this study was moist, an ideal environment for breeding *A. lumbricoides*. Thus, environmental sanitation and personal hygiene probably play important roles in the higher prevalence rate of Ascariasis in the present study area. Also, the present study revealed a correlation between the raising of dogs and the prevalence of helminthic infections (OR = 2.444, 95% CI = 1.080-5.534), especially for *A. lumbricoides*.

One of the limitations of the Kato's thick smear technique is that eggs of *O. viverrini* and minute intestinal fluke cannot be differentiated. Therefore, opisthorchiid-like eggs found in this study may be from *O. viverrini* or minute intestinal fluke infections. A previous study showed that 78% and 69% of eggs initially assumed to be *O. viverrini* in Nan and Lampang Provinces, respectively, were *Haplorchis taichui*[24]. Similarly, previous studies in Lao PDR found that the prevalence of the minute intestinal fluke was higher than the prevalence of the liver fluke[25,26]. Therefore, there needs to be further confirmation of opisthorchiid-like eggs found in the present study.

In conclusion, the high prevalence of helminthic infections among the volunteers in Nanglae Sub-District, Muang District, Chiang Rai Province was an indication that helminthic infections are still a public health problem in this area. The present study revealed that *Taenia* spp., *A. lumbricoides*, and *S. stercolaris* were common helminthes that cause helminthic infections of varying magnitude in the study area. It also found correlations between regular consumption of raw meat and tapeworm infections, and between the raising of dogs and the prevalence of helminthic infections, especially *A. lumbricoides*.

There was no significant correlation between good practices, such as always washing hands with soap before meals and after defecation, with the prevalence of helminthic infections. However, the present study recommends that enhancing socio-economic status, improving sanitation facilities, installing health education, and promoting personal hygiene may be the good strategies for controlling helminthic infections and preventing the spread of parasitic diseases in this area.

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Potential conflicts of interest

None.

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ความชุกของการติดเชื้อหนอนพยาธิและปัจจัยเสี่ยงของชาวบ้านที่อาศัยในตำบลนางแล จังหวัดเชียงราย ประเทศไทย

วัชรพงษ์ เรือนคำ, นพวรรณ บุญชู, พัชรา ก้อยชูสกุล

การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อสำรวจอัตราความชุกของการติดเชื้อหนอนพยาธิและศึกษาปัจจัย ที่มีความสัมพันธ์ต่อการติดเชื้อหนอนพยาธิของชาวบ้านที่อาศัยในตำบลนางแล อำเภอเมือง จังหวัดเชียงราย การศึกษาครั้งนี้มีผู้สมัครใจเข้ารับการตรวจ จำนวน 263 ราย ศึกษาอัตราความชุกของการติดเชื้อหนอนพยาธิ ด้วยการตรวจอุจจาระหาไข่พยาธิโดยวิธี Kato's thick smear technique การวิจัยได้ดำเนินการระหว่างเดือนมกราคม ถึง มีนาคม พ.ศ. 2556 ข้อมูลทั้งหมดถูกนำมาวิเคราะห์และนำเสนอด้วยค่าสถิติเชิงพรรณนาได้แก่ ความถี่ ค่าร้อยละและหาความสัมพันธ์โดยใช้ Odds ratio (OR) ผลการศึกษาพบว่าอัตราความชุกของการติดเชื้อหนอนพยาธิ ในกลุ่มตัวอย่างเท่ากับร้อยละ 11.8 โดยพบพยาธิตัวตืดมากที่สุด ร้อยละ 6.1 รองลงมาได้แก่ พยาธิไส้เดือน ร้อยละ 4.5 พยาธิเส้นด้าย ร้อยละ 0.8 และพยาธิใบไม้ ร้อยละ 0.4 ตามลำดับ การศึกษาครั้งนี้พบว่าอัตราการติดเชื้อหนอนพยาธิมีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติกับพฤติกรรมการบริโภคเนื้อสัตว์ดิบหรือสุกๆ ดิบๆ เป็นประจำ (OR = 2.270, 95% CI = 1.047-4.923) และการเลี้ยงสุนัข (OR = 2.444, 95% CI = 1.080-5.534)
